TOYS

For the Physics Classroom

Courtesy of Chuck Hollocker

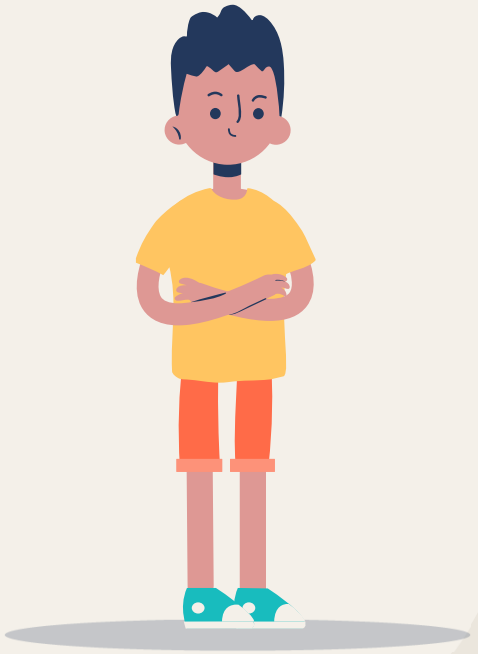
“If Physics isn’t fun, then you are teaching it wrong.”

—Chuck Hollocker

Minimum Toys for Multiple use

Here’s what you’ll find useful for many applictions:

- Assorted water balloons.
- Laser pens; red and green (they have different energies
- Tennis Balls
- Hot wheels
- String
- Springs and rubber bands
- Metal balls (assorted sizes)
- Construction supplies:
    - Popsicle Sticks and Tongue Depressors
    - Assorted Rubber Bands
    - Colored Pencils
    - Scotch Tape



The balloon

The Balloon is a very necessary and versatile addition the classroom toybox. It can be used to demonstrate:

- Static electricity
- Gravity. (from a known height, a student drops a water balloon on a motorized car. They must calculate when to drop, based on the position and speed of the car.
- Stored/potential energy (if the students don't be leave you, squeeze the balloon until it pops, transforming the energy stored in the deformation of the rubber into sound energy).
- Surface tension and strength material (you can stick a pin through the balloon from end to end without breaking it. You can even use a straightened paperclip.)
- Momentum and impulse (wear a loose-fitting parka and have a kid throw a water balloon at you It won't break until it rolls to the ground)
- Jet propulsion.

I use standard water balloons

Laser Pens & The Water Balloons

Teaching about properties of light and color can be a challenge. To help key concepts across, try this:

R+G+B= white. Blow up a balloon of Red, Blue, and yellow color.

Using the laser pens, determine which balloons reflect which color?

You see red when red is reflected. Red light reflects off of the red balloon. The green light is absorbed! If you shine the green light long enough, the red balloon will pop.

Green will not pop the green balloon because it reflects the energy of the green light.

Will the red light pop the green balloon for similar reasoning. Actually, NO. Look at the spectrum. Red has a lower energy level. Cool.

The green light will not pop the yellow balloon because Red+Green=yellow. The green is reflected again.

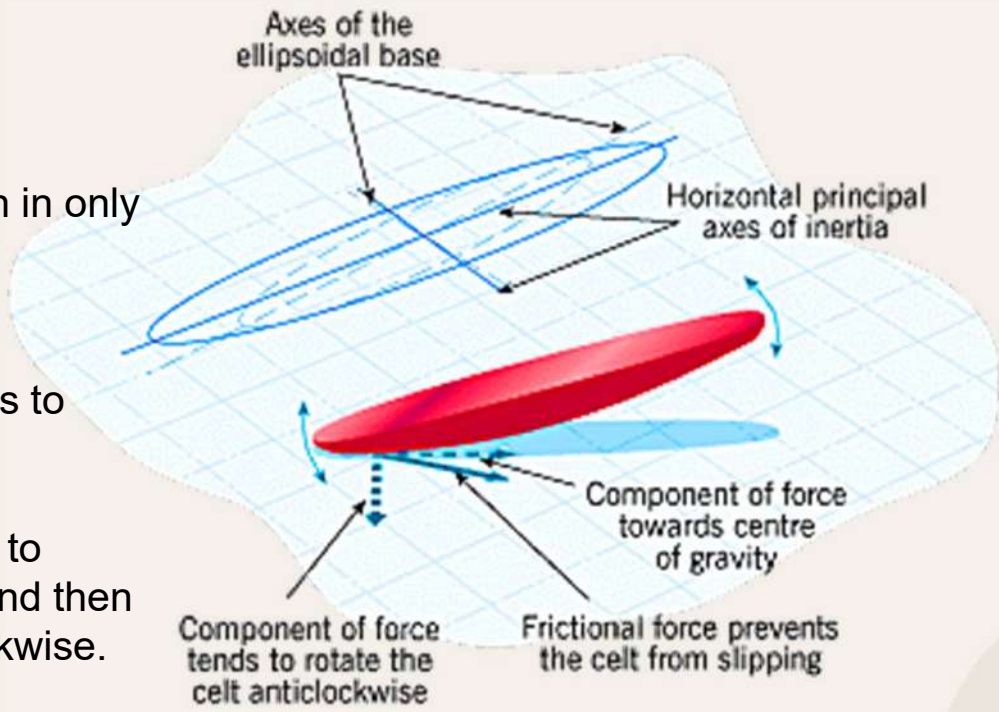
NOTE: high energy pens are required.

The “Rattle-Back”

1.This is an ancient Egyptian toy that likes to spin in only one direction.

2.Tell the student to spin the rattle back counterclockwise. It does so quite willingly. It likes to spin counterclockwise.

3.Now tell the student to spin it clockwise but not to touch it again. It will continue counterclockwise and then abruptly stopped and starts spinning counterclockwise.



4.Lead a discussion trying to determine why.

5.We assume, because of the shape, that the center of gravity is right in the middle of the toy. But, it is off-center, causing the toy to fall forward when spun counterclockwise, but to fall backwards when spun counterclockwise. Thus, it decelerates and starts to go in the opposite direction.

Astroblaster

We know the ball cannot bounce higher than the height from which it is dropped.

- But when that ball hits the floor it deforms, storing energy, waiting to be released.
- In combination, as demonstrated by this toy, each ball releases energy to combine with the subsequent ball.
- Hence, a little red ball on top shoots off with remarkable force that will have it hit the ceiling.

- Wear goggles when you do this and don't do it near any students.

- A similar effect can be achieved by dropping a basketball with a tennis ball on top.

The “Popper”

Reversing the popper stores energy. After a moment it “pops” back into its original shape, sending it skyward.

- Have the students use the scientific method to find an average height to which the Popper flies.
- This information along with the mass of the Popper and the acceleration of gravity can be used to determine the potential energy at maximum height.
- This will be equal to the original potential energy of the deformed Popper and equal to the kinetic energy of the Popper in motion just before maximum height.

- You may have to "work" the Popper to get it to stay in the deformed state long enough to set it down. Working the Popper provides some heat from deformation to loosen it so it works.
- Note that we are assuming totally efficient deformation and return.

“Space Phones”

This is a stupid toy, but a great physics demo for waves.

- Do you remember the tin can and string telephone from your childhood. Well, this works on the same principle, but too well for its intended use. Transmission can be so loud that one child shouting could hurt the other child’s ear.

- I use these to demonstrate the difference between longitudinal and transverse waves. (all sound is longitudinal) When you shake one phone vertically you see the transverse waveform in the spring, but you hear nothing.

- If you stretch the spring, and run your nails along it, it makes a really cool sound because of the longitudinal nature of the wave.

Steel Balls

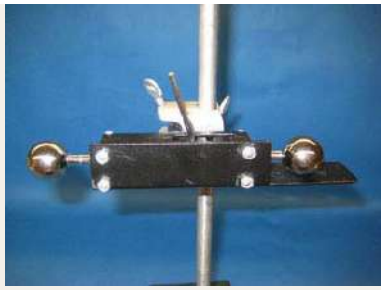
Take a steel ball in each hand and bring them together suddenly. They stop. They clearly had kinetic energy but it went away.

- But were did it go? Repeat the process, but with a student holding a sheet of paper between the balls when they meet.

- You will see that most of the energy is released as heat energy, burning a hole in the paper which you can smell. Additional energy is lost in the form of sound energy, which is no surprise.

- I had a kid in the back of the room, trying to start a fire using this method. Of course, it did not work but when I got the steel ball bearings back they were dimpled from the Force like golf balls. Watch your students.

Projectile Launcher



A projectile launcher drops one ball at the same instant it shoots another horizontally. Which will hit the ground first?

Not only can you hear them hit the ground at the same time but you can also hear them bounce at the same time. Way cool. Guaranteed to make believers out of the students.

Donut Magnets

Doughnut magnets are great for teaching magnetic polarity.

For example, in the picture shown, if the top magnet has got the North Pole on top, what is the bottom pole on the next magnet?

Students should be able to trace polarity all the way down the stack.

Energy Balls

- Looks like an ordinary ping-pong ball, but the Energy Ball is anything but ordinary. Touch both of the small metal pieces on the bottom of the ball and it flashes and generates sound. By touching both the metal strips at the same time, you are closing the circuit, resulting in light and sound. (about $8)
- Have a few of your students hold hands. You touch one electrode and the student at the end of the chain touches the other.
- You send a current through them back to the ball.
- Tell one of the students to let go. The circuit is broken (open) and the light/sound stops.
- Great intro to circuits and continuity.

Where to get toys and supplies

https://www.sciplus.com/ one of my favorites.

https://www.schoolspecialty.com/science-supplies-and-products includes FREY products

https://www.enasco.com/c/Education-Supplies/Science/Physical-Science

https://www.fishersci.com/us/en/home.html

https://www.pasco.com/

https://www.arborsci.com/

https://www.vernier.com/physics/